

Controlling Rats in Macadamia Orchards

By Mark E. Tobin

Rats damage 5-10 percent of the developing macadamia crop in Hawaii. Damage can occur at any time during nut development, from the time the kernels are soft, fleshy unprotected fruits to when they are fully developed and surrounded by hard shell and a fibrous husk.

Three species of rats occur in Hawaii: black rats, Norway rats, and Polynesian rats. Black rats are the major rodent pest of concern in macadamia orchards. A recent study of the stomach content of roof rats captured in a macadamia orchard indi-

cates that rats can subsist and breed year-round on a diet composed largely of macadamia nuts.

In spite of the apparent impact of rats in orchards, little is known about their behavior. Seasonal variations in the abundance and quality of nuts undoubtedly influence the density, home ranges, and movements of rats in orchards. Additional studies about their daily and seasonal movements would provide the basis for implementing more effective control strategies.

For instance, knowledge of the


home ranges of the rats would indicate the amount and spatial distribution of traps, rodenticide baits, or other measures necessary to control troublesome populations.

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An understanding of seasonal variations in rat behavior is critical in determining the best times to apply control measures. Currently, many growers wait until after the harvest season to apply control measures. However, we are uncertain about the extent to which rats leave the orchards at harvest time to seek food elsewhere.

A radiotelemetry study of rat movements in orchards indicated that they move limited distances in mature macadamia orchards. There was little movement in and out of the orchard, and all rats had restricted home ranges that averaged about .5 acres. Based on these movement patterns, growers who use traps or apply rodenticides in bait stations should place them throughout their orchards at two or more locations per acre.

Rat problems usually increase as orchards mature. We find the most

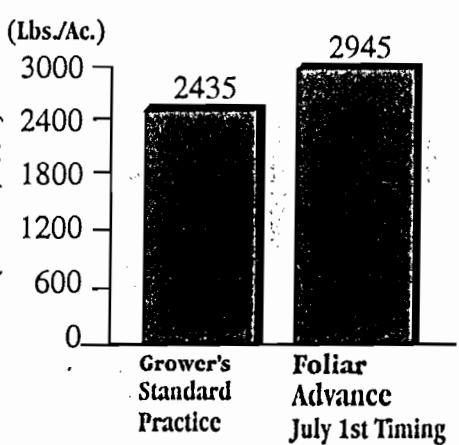


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extensive damage in orchards 20 or more years of age. The canopy in such orchards provides safe nesting sites and interlocking branches that allow rats to move unhindered among trees. This in large part is what attracts rats.

Traps can be effective in reducing rat populations in small orchards, but are labor intensive and probably not cost-effective for protecting larger orchards. We routinely trap rats during our studies. Coconut is a very effective bait. Rolled oats and peanut butter also work. Growers who use traps should cover them to protect from cardinals and other birds.

Rodenticides are the most practical way to protect large areas. Two rodenticide products currently are registered for use in macadamia orchards: Hopkins Zinc Phosphide Bait and ZP Rodent Bait AG. Both have zinc phosphide as the active ingredient. Our laboratory testing indicates that the former bait is the more effective of the two for killing black rats.

A major problem with both baits is something we call bait shyness. Rats that consume sublethal doses learn very quickly not to eat any more bait. Thus if the bait did not kill the rat the first time, it will not do any good to put out more bait. The rat will simply ignore it.

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For the same reason, growers should not leave zinc phosphide bait in orchards on a continuous basis because it will reinforce rats' aversion to the bait. Due to the mild climate and prolonged crop season in Hawaii,

we need to control rat populations over an extended period.

Anticoagulant rodenticides like Eaton's Bait Block, Talon and Maki might be alternatives if they were to be registered for orchard use. Anticoagulants have a different mode of action from that of fast acting poisons like zinc phosphide. Rats usually do not get sick until 3-4 days after eating anticoagulant baits and thus do not associate their illness with the bait. My laboratory plans to study the effectiveness and safety of anticoagulants for reducing rat populations in macadamia orchards.

Inappropriate application methods may reduce the effectiveness of some operational baiting programs. Our studies indicate that in many orchards, rats spend very little time on the ground and are unlikely to eat bait

placed there. This is probably because rats on the ground are vulnerable to predation by cats, mongooses, and other predators, especially in orchards with little ground cover.

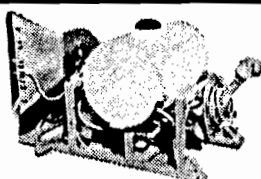
We are currently conducting a study to determine where in the orchard the rats are most likely to eat bait. We are using a biological marker to determine whether rats eat bait placed in the tested orchards.

So far, it appears that bait placed in trees is more likely to be eaten than either broadcast bait or bait placed in burrows. In the tested orchards, broadcast baiting does not seem to be very effective. Growers should place bait in the trees to get maximum acceptance by rats.

Dr. Mark Tobin is a research biologist with USDA's Denver Wildlife Research Center in Hilo, Hawaii.

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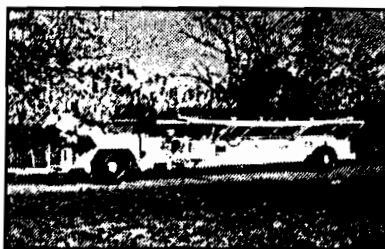
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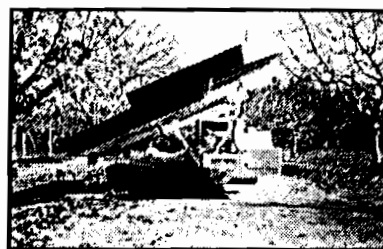
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